OCEANUS

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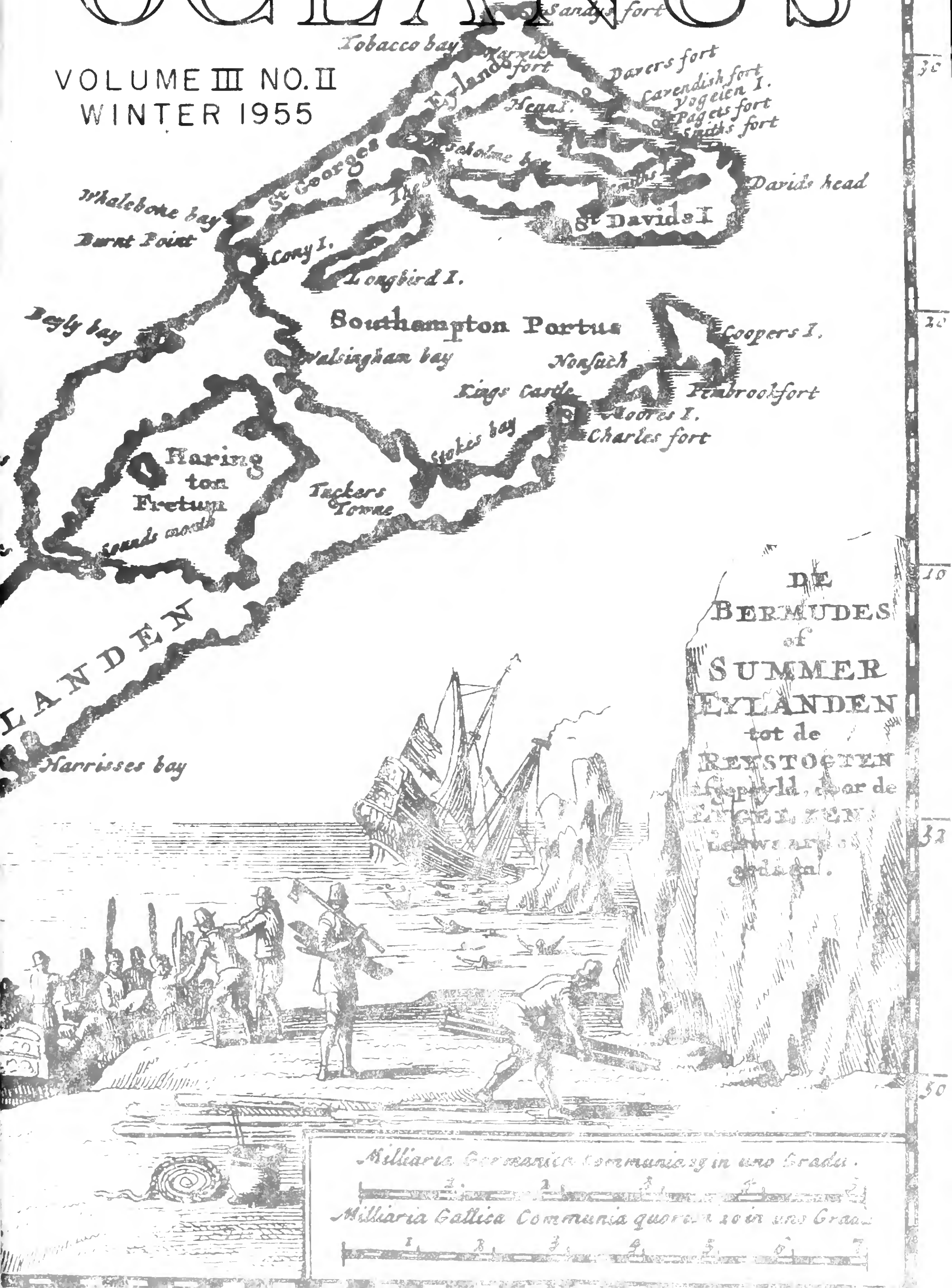


OCEANUS

EDITOR: JAN HAHN

Published quarterly and distributed to the Associates of the Woods Hole Oceanographic Institution and others interested in Oceanography.
Composed and printed by the reproduction departments of the Institution.

THE ILAND OF DEVILS (OTHERWISE CALLED BERMOOTHAWES, ALIAS SUMMER ISLANDS)

A favorite way station for oceanographers, Bermuda was not attractive to earlier 'tourists' who were cast away on its many reefs. Generally they managed to build boats of "Cedar and other timber, but chiefest Cedar", and sail off to Virginia or to the Newfoundland Banks where fishermen from France or England could be encountered.

Henry May, who was shipwrecked with a French vessel in 1593, declared: "The 11 of May 1594 it pleased God to set us cleare of the Island, to the no little joy of us all, after we had lived in the same almost the space of 5 moneths."

In 1609, the crew of the wrecked "Sea Adventure", carrying Sir Thomas Gates and Admiral George Somers to the Virginia Colony, found the islands so pleasant that they sabotagea the building of a vessel, although upon arrival they stated: "We have reached a dangerous and dreaded island or islands, considered terrible by all who have touched them."

The map on our cover was printed by Pieter van der AA at Leyden in 1706. Probably it is a copy of Norwood's published in 1626 after an excellent survey made in 1617. The nearness of Virginia may be due to wishful thinking.

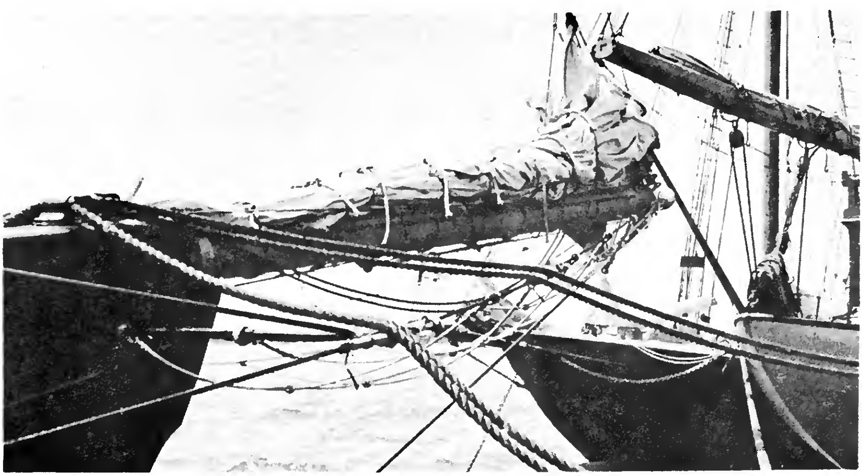
EDITORIAL

Frequently we are asked: "But what is the practical outcome of your work?" This can annoy the research scientist, since he is more interested in the how and why, than the wherefore. As the present phase of oceanography is still largely observational this question cannot always be answered. To be sure, many practical applications came about as the result of particular investigations. Compared, however, to the magnitude of man's possible role as master of the physical well-being of the earth, such applications have not been large.

Dr. Spilhaus provides a look into the future in his article: "Sea and Air Resources." It is not often that we may obtain a view of the magnificent future that man could shape for himself by a concerted effort to observe, understand, predict and, finally, control his physical surroundings.

Although it is the policy of *OCEANUS* to obtain original contributions we could not refrain from reprinting his paper which first appeared in the *Geographical Review*.

Dr. Spilhaus has given us much to think about. Let us hope that the social sciences will keep pace to enable mankind to accept and make wise use of its possible powers.



BOOKS by STAFF MEMBERS

Fishes of the western North Atlantic. Ch. 1. Batoidea. Ch. 2. Holocephali. H.B. Bigelow and W.C. Schroeder, Mem. Sears Found. Mar. Res. New Haven, Conn. 1953. 1(2): XV, plus 562 pp., index, figs.

The indefatigable authors of "Fishes of the Gulf of Maine" and of other scientific papers have produced another monumental book. Covering all that is known about the sawfishes, guitarfishes, skates, rays and the strange chimaeroids - a modified brand of primitive fish - the book is not a compilation of available knowledge but a critical review of the vast amount of published material. It is studded with meticulously accurate descriptions and illustrations.

As other books by the authors, it is written in a lucid style, so that it is useful not only to scientists but to everyone interested in the sea. This premise is one of the requirements of the projected series on fishes in the Western North Atlantic covering the area from Hudson Bay to the Amazon River, including adjoining Gulfs and Seas. The first, published in 1948, was concerned chiefly with sharks.

That Dr. Bigelow and Mr. Schroeder both spent a lifetime catching fish by line, net and trawl is frequently apparent under the heading: "Relation to Man." "Sawfishes," we read: "are too sluggish to be held in any regard as game fishes by anglers. Once hooked they swim so powerfully, though slowly, and are so enduring, that the capture of a large one entails a long and wearisome struggle -- on one occasion it required more than two hours for one of us to subdue a 14 foot sawfish on a handline from a small boat."

An excellent addition to the reference shelf of any library.

Elements of Ecology, George L. Clarke, John Wiley & Sons, N.Y. 1954, 536 pp. illus.

The general reader who wishes to know more about the life cycle in the sea and the fundamental scientific concepts underlying the development and conservation of aquatic and terrestrial resources would be well advised to acquire this book. Dr. George L. Clarke, Associate Professor of Zoology at Harvard and Marine Biologist on our staff has

written an understandable account of the interrelations between plants and animals and their environment on land and in the water. The student and advanced worker will find an excellent textbook and the general reader who wants to know how the world of life works, will find a wealth of information. Abundantly illustrated with photographs, graphs and diagrams.

D.M. Owen

A Manual for free Divers, D.M. Owen, Pergamon Press, London, 1955, illus.

The increasing popularity of free diving with compressed air equipment has not been accompanied with a knowledge of the dangers and difficulties that may be encountered. David M. Owen, our chief diver and underwater photographer provides the amateur swimmer with practical information on the mechanics and physiology of free diving with compressed air. The manual makes a valuable contribution to water safety of this sport. A request for translation into Norwegian has already been received. The book is distributed in this country by the Fenjohn Underwater Photo and Equipment Co., Ardmore, Pa.

St. Georges

Lat. 32° 23′ North. Long. 64° 42′ W.

For those interested in navigation, the longitude 313° on the cover chart may be puzzling. In the 17th century the prime meridian was generally fixed on the island of Hierro in the Canaries group. Longitude was expressed in degrees east, therefore 313 degrees east of Hierro is equal to about 65 degrees west of Greenwich.

GIFTS and GRANTS

Our Director, Rear Admiral Edward H. Smith, reports that the following gifts and grants have been received:

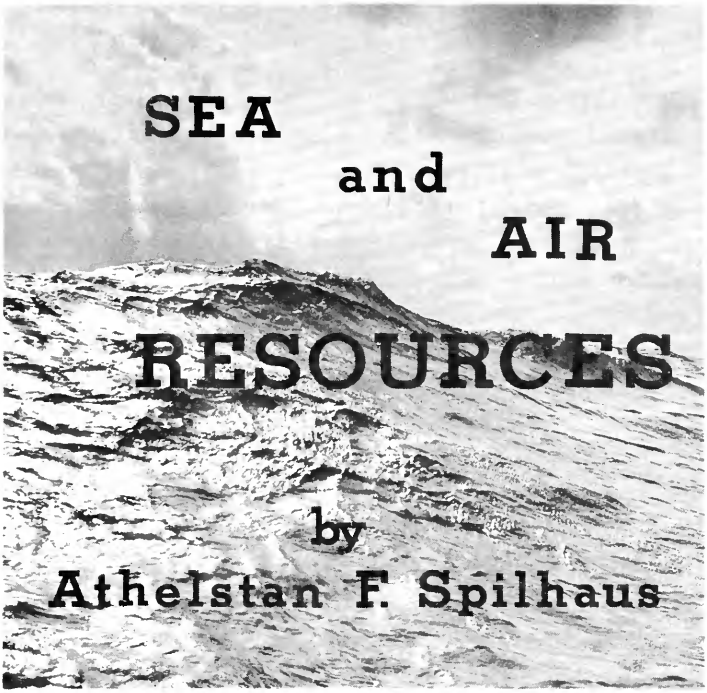
National Science Foundation............	$ 11,700
American Bureau of Shipping............	2,000
Humble Oil Company.....................	1,000

A gift of stock certificates was received from Mr. and Mrs. Ferdinand Eberstad, Associates.

The grant from the National Science Foundation was made to assist Dr. B.H. Ketchum and Ralph F. Vaccaro in the study of bacterial activity in the ocean which breaks down organic matter into fertilizing elements, suitable for the growth of plants. These processes have been studied in coastal waters and in bottom sediments, but little is known about them in the open sea.

If man is to take more food from the sea, we need to obtain a complete knowledge of the life cycle in the sea, the ocean's fertility and its productivity. It is hoped that the work of Dr. Ketchum and Mr. Vaccaro will supply the answer to one more basic problem, so that in the future the ocean's resources can be utilized intelligently and efficiently.

The article 'Sea and Air Resources', is reprinted with the permission of the Geographical Review.



SEA and AIR RESOURCES

by Athelstan F. Spilhaus

THERE are three basic resources on our planet—water, air, and rock. Each contains valuable things that we can extract with power. Geophysics in its corresponding phases is the application of all basic sciences toward the understanding of the hydrosphere, atmosphere, and lithosphere. If, therefore, we ask the question, "What can geophysics contribute to the development of resources for the future?" we are really making the naive query, "How can understanding the three basic components of our planet help us to exploit them?"

Because man is essentially land-bound, two tendencies are apparent in the three geophysical divisions. First, he has divided and specialized into many parts the application of science to the best utilization of the emergent land-rock as a resource. But, secondly, he has regarded the atmosphere and the ocean as obstacles and has studied them as such, with emphasis on those vagaries in each which are to be avoided or against which he must protect himself. He has not, in general, pursued the understanding of the air and ocean as a tremendous reservoir of things that are needed for living in the future—as a vast natural resource.

➤DR. SPILHAUS, a well-known oceanographer and meteorologist, is dean of the Institute of Technology at the University of Minnesota, Minneapolis. He is also on the staff of, and a trustee of, the Woods Hole Oceanographic Institution.

Fortunately, meteorology and oceanography have not yet been broken into compartmentalized, specialized fragments, as have the sciences applied to aspects of the land-rock: we are becoming increasingly aware that in order to understand the ocean one does not study oceanography. Rather, meteorology and oceanography are the result of trained minds in the different basic sciences directing their attention to the atmosphere and the ocean.

It has been said that the water is the slave of the air; if so, it is a mutual bondage. The attack on sea and air as a resource must be made on both as a system, and not separately; neither can the influence of the land-rock on both sea and air be neglected. The interaction of air and sea is so intimate that one must understand both in order to understand either.

The chief resource of the sea is not fish, not salts, not magnesium, or any of the myriad of other valuable things that can be extracted from it—the greatest resource of the sea is *water*. And it is by the interaction of air and sea plus the energy of sunshine that this water is made available to us. The fresh water that reaches the land is used for certain essential purposes: to grow food; to utilize recently arrived solar energy through hydropower; and to carry off waste (including industrial and human). This last is by far the least important and should not interfere with the use of water for the other two, since all water for carrying off waste can be reprocessed and used for the main purposes.

The basic processes of evaporation from the ocean, condensation in the air, and precipitation on the land constitute the essential working of the earth's solar distillery. Yet, in spite of the importance of water, they are virtually not understood. The trouble with water as it comes naturally from the sea is that it is unsuitably distributed in time and in space, and one of the major objectives in resource research in the next 50 years should be time and space control of all phases of the natural water cycle.

Climatic Control

Control of our environment and its resources must be man's ultimate aim in geophysics. Climate control pertains to all phases of the earth's water substance and temperature and winds (important principally as the carriers of the water substance and heat). Control of these would ultimately (1) take the weather problem out of farming; (2) make present "waste" lands available for farming and thus contribute mightily to solving the short-range (50-year) food problem; (3) make areas now inundated suitable for the raising and harvesting of foodstuffs. If the present annual world rainfall were suitably distributed in space and time, there would be ample available.

In all sciences there should be a somewhat logical sequence of stages leading to control—observation, understanding, prediction, control. We must observe before we can understand (this does not, of course, preclude a theory that forms the design of the observational phase). We must understand before we can predict. And, above all, we must be able to predict the outcome of a set of circumstances, natural or artificially induced, before we exercise control. Very often, and particularly in the social sciences, this sequence is not observed. I do not, however, wish to preach a slavish adherence to it that would preclude valuable heuristic discoveries in the latter phases that might be followed later by understanding. What I do mean is that we should lay the groundwork of observation and understanding now if we are to be able to utilize properly this resource of sea and air when we shall need it. The meteorologists, oceanographers, hydrologists, and geographers who are to attack this problem of total water control will need to be concerned about every aspect of it, not only that part of the cycle which is in the oceans and the air but the way in which controls of water are exercised by the engineers on the land surface.

The basic purpose of the rainfall part of climate control is to take water from places of excess to places of deficit and to even up the times of excess and times of deficit at any one place.

Let us take for a moment the extreme view that none of Nature's distillate which falls on land should be allowed to return to the sea before it has been used to the maximum extent. We could change the hydrologic cycle by increasing the part that returns to the sea through transpiration of plants. This would reduce the flow of rivers into the sea. Perhaps, indeed, we could eliminate the need for any flow of fresh water into the sea. This does not mean the elimination of rivers as useful waterways and aqueducts; it simply means no flow at the mouth into the sea.

Desert Culture

Sand culture in deserts is possible if there is enough water. Natural canals (rivers) that carry water turn deserts into verdant gardens supporting teeming populations. Uniform space distribution of net water supply might be achieved by artificial canals of the scale of the Nile River and make another part of the Sahara productive by the end of this century. Though these world-scale engineering projects of future geotechnologists now appear mammoth, they loom no bigger than present-day engineering accomplishments would have appeared at the beginning of the century. It is inescapable, however, that such large projects will affect climate, and we should understand how before they are carried too far.

Natural lakes tide farmers over periods of dryness; suitable time distribution of water supply can therefore be accomplished, and is, by storage of water above the ground in artificial reservoirs or below it in natural underground basins. Should we use above-ground or underground storage? This must be determined by prediction of what the effect of manifold dams will be on climate, and also by consideration of the competing demands for the use of land.

Engineers have historically neglected the medium or environment with which they have to deal. For example, when the Wright brothers flew a machine off the ground, it was said that man had conquered the air, but not until much later was it found that the study of the atmosphere was necessary for aircraft operation. Ships have been built for centuries, yet even the most modern ones are not designed for a sea with waves in it. Speed in smooth water has been considered the criterion—a highly unnatural one.

Tracked vehicles for agriculture and wartime uses on land still bog down in some kinds of terrain, and only control of the medium of the land by soil

Erosion cutting down a forest

stabilization can solve the problem. So it is that engineering control of water is going forward without the scientific knowledge of the hydrologic factors which could do so much to aid it.

I have spoken so far only of the equalizing of time and space distribution of water on the land by the obvious brute-force methods of mammoth engineering works, ultimately measured in power expended. Possibly, if a concerted attempt were made to understand the physics of precipitation, both time and space distribution of water and heat could be achieved by subtler and more sophisticated means, and with expenditure of much less power, by controlling the formation of rainfall before it hit the land.

A fertile valley in the Azores

Control of Evaporation

More difficult to envisage but not inconceivable is the control of evaporation. Mulches are already used, and reforestation is attempted, though the true effects of these on evapotranspiration are not really known. Deserts occur, not necessarily where rainfall is low, but wherever evaporation exceeds rainfall and dew. Some plants have the mechanism to absorb dew at night and not transpire during the day, and they bloom in the desert—a hint perhaps at a mechanism for reducing evaporation in these areas. A corollary to water control and more even distribution would be the moderation of temperature extremes.

Just as water control will have an influence on temperatures, so temperature control will have an influence on water distribution. Temperature control may be accomplished in the future by the proper distribution of artificial or natural reflective and absorptive coverings. I have heard, for example, that dyes may be used to increase the absorption of solar radiation, and hence the evaporation in salterns. Also, the possibility exists of cutting down the reflectivity of snow and ice surfaces. These means of controlling the utilization of incoming solar radiation at the earth's surface should not be underestimated.

So far we have considered the air-ocean water resource in relation to land, but with the ocean covering more than two-thirds of the earth's surface it is well not to forget the effect of the cycle of water and other materials on the sea itself and on its products.

Of course, complete land-water conservation renders soil conservation unnecessary—if all the water returns to the sea by transpiration, soil cannot be

lost except through wind erosion. On the other hand, the fertility of the sea for the production of fish might be affected by cutting off the supply of nutrients leached from land. Here again, however, it would seem that, if we understood what materials are necessary to the optimum production of ocean fish, an artificial and controlled addition of these in the right places would result in an improvement. The natural, hit-and-miss system of the rivers washing material into the sea may result in robbing the land of nutrients valuable to it but useless for raising ocean plants and fish.

Farming the Sea

It is not the purpose of this paper to do more than sketch the broad outline of the problems of future utilization of the resources of sea and air. However, the whole problem of the exploitation of ocean plant and fish life in relation to increase of human population is one that not only is important but illustrates the need of the fishery biologist-oceanographer-meteorologist-engineer-geographer team for its solution. The ultimate objective in the exploitation of the fruits of the ocean as food is also one of control.

Just as optimum farming on land involves controlled breeding, controlled feeding, controlled harvesting, and so on, so ultimately must similar controls be devised for the farming of the sea; perhaps the culmination of these is far in the future, but again the basic understanding should be laid now.

The sea is regarded by many people as a tremendous potential supplier of food, but some marine scientists believe that the potential is exaggerated. We cannot *know*, because our fishing methods are so primitive that we have little idea of the efficiency of our harvesting. There is no doubt that through a serious effort these methods could be greatly improved, but such improvement should go hand in hand with understanding efforts at selection and "domestication"—if one may employ that word for an area as vast as the world ocean.

From work now under way there are indications of an intimate relation between atmospheric processes such as winds, changes in the physical environment of the fish, and the productivity of the fish—hence the catch. Some believe, for example, that where the winds diverge and ocean water upwells, one should find the pelagic fish in great numbers. There are indications, too, that shifts in the major current systems—shifts hardly detectable by present observational methods—may cause migrations of the fish populations. These ocean-current shifts depend on changes in atmospheric circulation, and in the future a study of the weather map may tell the fisherman where to go for his optimum catch.

For long-range weather forecasting a study of the deep currents in the sea may provide a factor in prediction. In the ocean, just as for the air in the atmosphere, there is no smooth, steady solution for the transfer of cold water from higher to lower latitudes, and possibly, also as in the atmosphere, periodic pulses or outbreaks of cold bottom water effect this transfer. During these outbreaks the bottom currents may be much swifter than our present completely inadequate measurements would indicate.

What should we do now to develop the resources of air and sea? With regard to the water cycle of the atmospheric heat engine, and always with *control* as the ultimate objective:

1. We must study evaporation and evapotranspiration of plants. Plants may be useful instruments for control of evaporation, but, as with all other instruments, we must "calibrate" them in terms of the physical process we are attempting to control.
2. We must learn to understand the mechanism of nuclei in the atmosphere, both natural and artificial, and the physics of condensation and precipitation, with a view to developing artificial stimulants and inhibitors of precipitation.
3. We should consider the uses of natural polar ice as a possible source of fresh water (as suggested by John D. Isaacs) and estimate the correlated effect any large-scale effort of this kind would have on climate.
4. We should investigate methods of utilization of fog and dew.

With regard to exploring and developing the food resources in the sea, and again with control as the ultimate objective:

1. We should study fish as sensitive indicating instruments of their physical-chemical environment. Here, also, as with any other instrument, we must calibrate them in terms of the mutual influences of the ocean life and the nitrates, phosphates, oxygen, silicates, and other materials.
2. We should study the needs of the fish or plants in the ocean with a view ultimately to introducing the materials artificially.
3. We should improve fishing methods so that a controlled number, size, and so forth can be taken.
4. We should study the habits, likes, and dislikes of ocean life with the ultimate aim of artificially confining it.

How should we organize to do all this? We should build up a global network of *observation* in sea and air. We should assist institutions where scientists in many different fields may devote their combined efforts to the problem of *understanding* the ocean and the atmosphere. We should add engineers to this group to keep in mind and work out the beginnings of control.

To summarize: If the control of the sea and air and the useful things in them is kept clearly as the objective in this search, it will be an objective large enough, and with such a tremendous return, that it should attract the best scientific minds.

End

ASSOCIATES NEWS

Income tax deduction.

We have received a ruling from the Treasury Department, dated January 3, 1955, that the Woods Hole Oceanographic Institution is an educational organization within the meaning of section 503(b)(2) of the Internal Revenue Code of 1954.

This ruling makes it possible for contributors to obtain an additional 10% deduction for charitable contributions. Copies of the Treasury Department's letter are available upon request.

Tagged Water

Water samples for deuterium determination are being collected during the present U.S. Navy Antarctic Expedition by a representative of the Hydrographic Office, U.S. Navy.

The program: "Tagged Water" was discussed in *OCEANUS* III, 1, and is partially supported by moneys from the Associates Fund.

Membership List

Copies of the Associates Membership List will be distributed with this issue of *OCEANUS*. Since the list went to press the following name should be added:

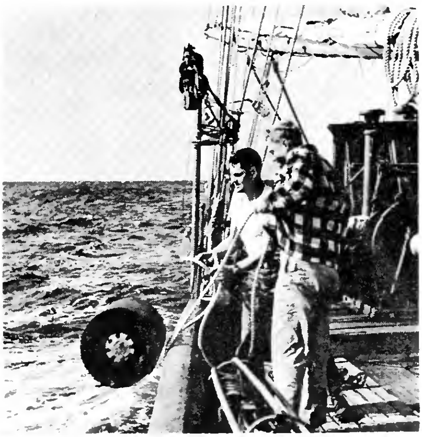
Corporate Associate:

Stanolind Oil and Gas Company, Tulsa, Oklahoma.

RESEARCH in Action

at the Institution is illustrated by papers recently published by members of the scientific staff. They show the diversity of the research performed here.

Earth's Structure



The structure of the earth under the continent and the deep ocean are discussed by M. Ewing and C.B. Officer Jr., in the *Bulletin of the Geological Society of America*. The thick layers of metamorphic rocks and granites which underlie Nova Scotia thin out under the continental shelf and are absent under the deep ocean basin. Seismic measurements showed that the crustal structure is four times thicker under eastern North America than it is under the deep ocean.

The carpet of sediment increases to 15,000 feet off the edge of the continental shelf and was found to be 3,000 to 4,000 feet thick in the deep basin off Nova Scotia.

Salt Droplets and Rain

Mr. Woodcock has suggested that minute salt particles found in marine air may play an important part in the triggering of rain showers. How these particles get into the air is demonstrated by C.F. Kientzler, A.B. Arons, D.C. Blanchard, and A.H. Woodcock in *Tellus*. High speed motion picture studies showed that when an air bubble breaks at the water surface a vertical jet of water rises into the air. This jet rapidly disintegrates into small droplets that eventually evaporate and form salt particles in the air.

Catastrophy to Marine Life

The birds that supply the Peruvian guano industry feed on anchovies which in turn feed on the abundant plant plankton of the coastal waters. Periodically, undue warming of the surface waters leads to catastrophy. The anchovies disappear and the birds subsequently migrate southward. These disasters have been explained by intrusion of warm salty water from offshore, or warm fresh water from the north. The latter occurence is known as El Niño. Observations made by Dr. Mary Sears showed another cause for this condition. Writing in *Deep Sea Research,* she reports that the local waters may become unduly warmed by the sun whenever the normal upwelling of cold, deep water does not take place.

Priscilla Knott and Barbara Atwood stringing shrimps for acoustical tests.

Sound Ranging

Underwater sound is rapidly becoming a useful tool in marine biology. Much remains to be learned about the scattering of sound by marine animals. For instance, how strong is the echo produced by animals of different size and different characteristics with sounds of different frequencies. An answer to this question is given by Paul F. Smith in *Deep Sea Research,* where some acoustical tests made on fishes, squid and shrimp are described. The information obtained can be used to evaluate several ideas concerning the scattering layers (see: *Oceanus* III,1) and will be useful for the development of fish detection by acoustical ranging methods.

Oxygen and the Organic Matter of Sediments

The supply and preservation of organic matter in bottom sediments is of great interest, as it is one source of petroleum. As living matter dies and sinks in the ocean much of it is consumed by animals which convert it into inorganic compounds. The remainder is buried in the sediment where it may, in time, be converted to petroleum. How much remains undecomposed in the sediment might be expected to depend on the oxygen content of the overlying water, which supports the respiration of bacteria and animals. This relationship has not been actually demonstrated.

In 1953, Dr. Parker D. Trask, an associate on our staff, described the organic content of the sediments of the Gulf of Mexico. Writing in *Tellus,* A.F. Richards and A.C. Redfield now show that the sediment richest in organic matter lies at just these depths where the oxygen is poorest.

Cumulus Clouds

In the *Journal of Meteorology,* Joanne S. Malkus reports on studies made by airplane on the development and structure of Trade-Wind cumulus clouds. She explains that a large cloud may be built up by successive stages of smaller clusters of clouds. Her measurements confirmed the Stommel-Malkus theory regarding the entrainment of outside air into a cumulus cloud.

Trade-Wind cumulus play an important role in worldwide weather by pumping vast quantities of moisture from the sea surface into the high atmosphere. In vapor form, this moisture then can be carried to the far corners of the earth, where its condensation gives off heat which is used as fuel for wind and storm systems.

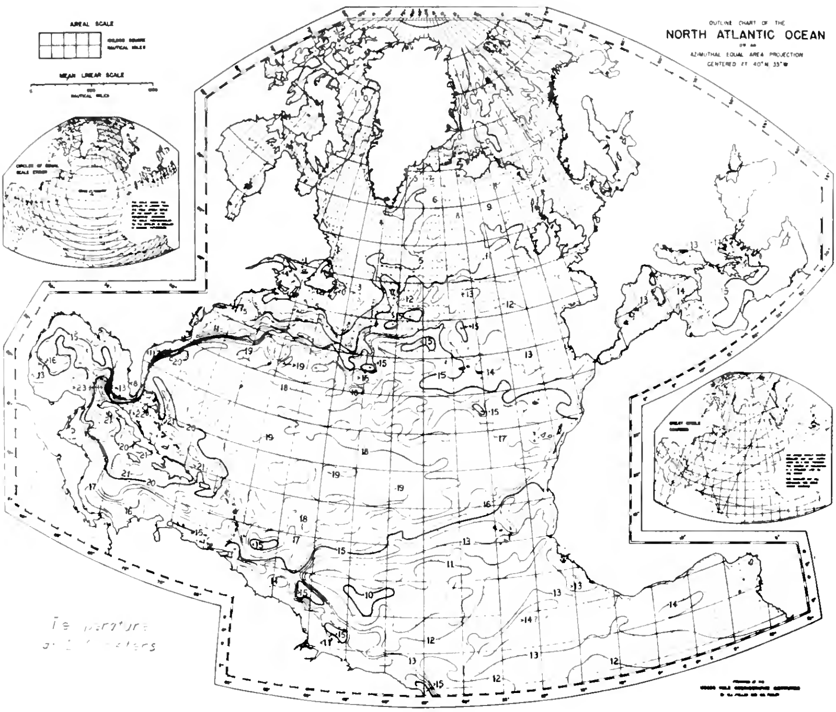
Marine Borers

John C. Ayers announces a simple and economical method to control and prevent damage by marine borers in the *Bulletin of Marine Sciences of the Gulf and Caribbean.* Panels protected by successive impregnations with copper sulfate and sodium hydroxide showed no damage after two years of submergence. Adjacent control panels were destroyed. To prevent galvanic action, wood so treated must be fastened with copper or brass fittings.

→

Oceanic Circulation

The permanent features of the circulation in the North Atlantic Ocean are depicted by F.C. Fuglister in *Tellus*. Charts, based on tens of thousands of observations, show the average temperature and salinity distribution at a depth of about 650 feet, where conditions are not influenced by seasonal changes. The author concludes that the average picture is somewhat misleading and should be supplemented by charts showing typical momentary conditions.



The charts show puzzling features which demand further investigation. For instance, although it has been commonly thought that a pronounced current extends from the Gulf Stream System in Mid-Atlantic toward the Norwegian Sea, the charts show no sign of it. Nor is there much evidence of the expected clockwise current system over the main body of the North Atlantic.

Captain Scott Bray holds a yellowfin tuna caught o/b ATLANTIS.

Ranges of Fish

The exploratory fishing of W.C. Schroeder has extended the known southward range of many northern bottom fishes. Now, F.J. Mather III records in *Copeia* some catches of warm water surface fishes in northern waters. He lists: yellowfin tuna, falcate amberjacks, king mackerel, blue runners, bar jacks and little dolphin. Some of the catches were made from our research vessels at sea, while others were taken in a commercial trap off Quisset Harbor, Buzzards Bay, Mass.

OCEANUS

How petroleum is produced and how to find oil deposits are subjects under active investigation by many geologists and chemists. The habitat of oil--the relationship of oil occurence to the depositional basin, will be the theme of a symposium to be held in New York on March 30, during the annual meeting of the American Association of Petroleum Geologists.

Dr. A.C. Redfield will discuss some of the findings obtained by him, Dr. B.H. Ketchum and Dean Bumpus in Lake Maracaibo on the coast of Venezuela. The paper "Preludes to the entrapment of organic matter in the sediments of Lake Maracaibo," concludes that the sea-connected lake is an unusually favorable place to study the entrapment and transformation of organic matter in sediments.

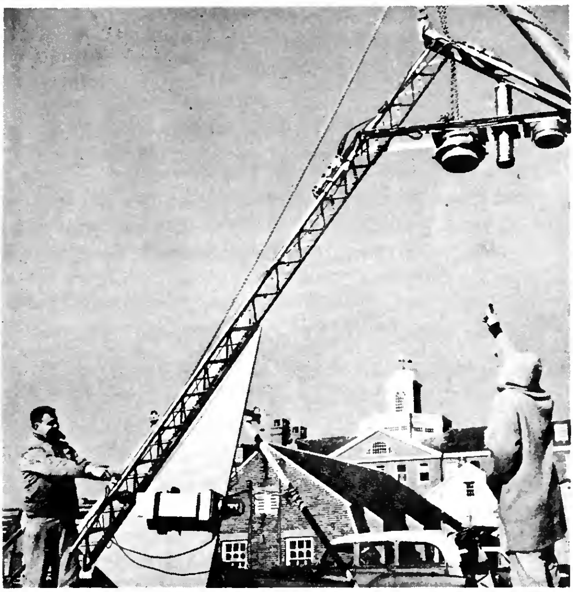
NEW Instruments

Recording of the ocean bottom by echo-sounding has constantly been improved during recent years. To meet the need for more precision which will provide more accurate information on the undersea topography of the earth's structure, Dr. J.B. Hersey's group has produced four rather complicated recording systems within a few months.

Called a versatile precision high resolution echo-sounding recording system, it uses facsimile recorders manufactured by Associate John M. Alden of Brockton, Mass. The system uses the electronics of commercial echo-sounders installed on our ships, but makes it possible to measure the travel time of the echo within an accuracy of one part in 30,000, i.e. at a depth of 30,000 feet is accurate to within one foot or better. It is possible also to "look at" the bottom, or at some particular interval between the surface and the bottom, on expanded scales.

Designer S.T. Knott and Dr. C.B. Officer Jr., checking recording system o/b ATLANTIS.

Using the ideas and help of many, Messrs. Herbert Small and Willard Dow developed the electronics for the system, while S.T. Knott and W.E. Witzell designed the mechanics and recording controls. Others assisting were Messrs. M.E. Edwards, H.A. Cain and A. Carter. The four, precisely machined, 18-speed drive units were produced in the Institution's instrument shop by Messrs. Ralph Bodman, M. Howland, N. Penniman, C. Grant and J. Gifford.



The "acoustical view finder"-

Sound sender and receiver at top right can "see" a fish or other animal as close as eight feet. The echo is recorded on board ship whereupon the camera, located between the sound heads is set off manually.

Light is supplied by an Edgerton electronic flash unit pointed out by Carleton Wing who built the instrument. At right is marine biologist Richard H. Backus.

One of the instruments presently is on board the *Caryn,* the other on board the *Bear.*

CURRENTS and TIDES

'The Anatomy of the Atlantic Ocean', is the title of an article by oceanographer Henry Stommel in the January issue of *Scientific American.* Mr. Stommel, at present, is contemplating at the Institute for Advanced Study in Princeton, N.J.

Mr. William C. Schroeder, ichthyologist, has been elected *Honorary Fellow* of the Academy of Zoology, India.

Articles about the Institution appeared in *Navy Times,* January 8 issue, and in the 1955 Northern edition of the *Inland Waterway Guide.*

Senior Oceanographer C.O'D. Iselin lectured on: *"Recent Developments in Oceanography",* to the Harvard Chapter of Sigma Xi. The meeting was open to the public.

Dr. A.C. Redfield and Mr. A.R. Miller presented their interesting findings regarding water levels produced by hurricanes at a meeting held in January at the U.S. Weather Bureau. The important problem of *hurricane* forecasting was discussed by many scientists.

Mr. W.V. Kielhorn arrived in December to be *Project Officer,* representing the Office of Naval Research, at the Laboratory of Oceanography.

The ships are off to the Caribbean and the PBY has followed suit. Meteorologists Andrew F. Bunker and John G. Fraser made daily flights from Bermuda with Captain Norman G. Gingrass and his crew. Dr. W.S. Richardson, Charles H. Wilkins, Charles E. Spooner and John G. Fraser are planning flights in the Puerto-Rico -- Virgin Island area.

Dr. J.B. Hersey appeared on the air on the Science Forum program of General Electric's Station WGY, Schenectady.

The Institution has adopted a non-contributory *retirement plan* for all personnel with a minimum of five years service.

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